R E P O R T R E S U M E S

ED 003 097 08

REPORT OF PLANNING CONFERENCE FOR VOCATIONAL EDUCATION SUMMER STUDY, APRIL 30 - MAY 1, 1965.

BY- FRANK, NATHANIEL H.
MASSACHUSETTS INST. OF TECH., CAMBRIDGE

REPORT NUMBER ERD-248-65 PUB DATE 65
REPORT NUMBER BR-5-0036
CONTRACT OEC-5-85-034
EDRS PRICE MF-$0.09 HC-$1.12 28P.

DESCRIPTORS- *VOCATIONAL EDUCATION, *PLANNING, SUMMER PROGRAMS, *EDUCATIONAL POLICY, PROGRAM DEVELOPMENT, PROGRAM IMPROVEMENT, CONFERENCES, CAMBRIDGE, MASSACHUSETTS

A 2-DAY PLANNING CONFERENCE WAS HELD FOR A LARGE NUMBER OF CONFEREES REPRESENTING A BROAD RANGE OF INTERESTS. THEIR PURPOSE WAS TO PLAN A VOCATIONAL EDUCATION SUMMER STUDY PROGRAM--(1) TO TAKE A FRESH LOOK AT THE WHOLE PROBLEM OF VOCATIONAL-TECHNICAL EDUCATION ON A NATIONAL SCALE, (2) TO WORK OUT PLANS FOR INITIATING SUCH EDUCATIONAL REFORM AS SEEMED NECESSARY, AND (3) TO START, IF POSSIBLE, THE IMPLEMENTATION OF SUCH REFORMS AS A CONTINUING EFFORT. INDIVIDUAL PAPERS WERE PRESENTED, AND SMALL GROUP CONFERENCES WERE HELD TO DETAIL THE PLANNING. (HB)

ED003097

5-0036

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

REPORT OF PLANNING CONFERENCE

for

VOCATIONAL EDUCATION SUMMER STUDY

April 30 - May 1, 1965

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Title: Planning Conference for Vocational Education Summer Study

Author: N. H. Frank, Professor of Physics, Massachusetts Institute of Technology, Principal Investigator

Contract: Vocational and Technical Education Contract OE-5-85-034, Vocational Education Act of 1963, Section 4 (c)

Grantee: Science Teaching Center, Massachusetts Institute of Technology

Acknowledgment: The Project Reported Herein Was Supported under a Contract with U.S. Department of Health, Education and Welfare, Office of Education

The arrangements for this Conference were made by the staff of the Science Teaching Center of the Massachusetts Institute of Technology.

Copyright © 1965 by the Science Teaching Center at the Massachusetts Institute of Technology

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

PLANNING CONFERENCE *for* VOCATIONAL EDUCATION SUMMER STUDY

BACKGROUND

STIMULATED by a request from Senator Kevin Harrington, Chairman of the Special Commission Relative to Improving and Extending Educational Facilities in the Commonwealth of Massachusetts, the Massachusetts Institute of Technology undertook an investigation of the feasibility of launching a program aimed at improving the effectiveness and recasting the pattern of occupational and vocational-technical education. At an organizational meeting on March 6, 1965 at the Massachusetts Institute of Technology, a distinguished group of educators (see appended list) expressed enthusiasm for the Institute sponsoring a large, intensive Summer Study to grapple with the complex problems in this area. The main objective of this Study would be to take a fresh look at the whole problem on a national scale, to work out plans for initiating such educational reform as seemed necessary and to start, if possible, the implementation of such reforms as a continuing effort.

INTRODUCTION

As a preliminary step in preparing for this Summer Study, a two-day Planning Conference was convened at the Massachusetts Institute of Technology on April 30, 1965. Made possible by the encouragement and support of Francis Keppel, United States Commissioner of Education and of his office, the goal of the Conference was to set broad guide lines for the Summer Study. The conferees (see list of participants), approximately one hundred in number, represented a broad range of interests and backgrounds. In addition to national representation, participants came from Canada, England and France.

The agenda for this Planning Conference was designed to provide as much interaction among and personal participation by the conferees as time allowed. With the exception of three general sessions, the participants met in relatively small discussion groups. Formal addresses were kept to a minimum and served mainly to state the objectives and set the tone of the Conference. Every effort was made to encourage active participation and uninhibited expression of opinions by the conferees.

SUMMARY OF PROCEEDINGS

At the opening session Dr. James R. Killian, Chairman of the Corporation of the Massachusetts Institute of Technology, reminded the Conference of the active role that the Institute has played, in the past as well as in the present, in the field of vocational education. A former President of the Institute, inspired by exhibits at the Philadelphia Centennial Exposition, had established a school of mechanic arts in the late 1870's. The PSSC and other innovative projects in which Massachusetts Institute of Technology has played a central role are evidence that this interest has continued into the present. In undertaking the challenge of improving vocational education, opportunity presents itself to start something new of great significance.

Following Dr. Killian's welcoming address, Dr. Walter Arnold, Director of the Vocational Division of the United States Office of Education, reviewed various steps taken by the Federal Government relevant to vocational education. He pointed out that modern federal

participation began in 1956 with the introduction of training in the broad field of health occupations. The Area Development Act of 1961 and the subsequent Vocational Education Act of 1963 finally opened wide the use of federal, state and local matching funds to all kinds of occupations, for training at all levels and at all kinds of institutions. All these pieces of legislation at the federal level constitute a kind of exploration of the government toward developing some kind of manpower policy. Dr. Arnold stated that the official position at the federal level is that of working toward a total balanced program of vocational education and he cited the state of North Carolina as an example of special progress in this direction. Finally, he cited as important problems that need consideration:

1. How do we bring meaningful information to young people and adults about the world of work?
2. How can we bring some reasonable degree of social prestige and status to the nonprofessional occupations in this country?
3. How can we help rural youths adapt themselves to an urban, industrialized society?
4. How specialized should vocational and technical training be and when should it begin?

Lawrence Watts, Assistant Superintendent for Instruction of the Jefferson County School District, Colorado, focused the attention of the Conferees on the "user-end" of education, at classroom and student level. He stated that too large a fraction of the 1963 funds are being poured down the same "rat hole" without the needed increase in quality, that there was too much re-shuffling of existing plans, too little innovation and too much use of existing channels of operation without opening up to a wider range.

Having utilized many of the new, innovative educational programs, his school system has concluded that the most important need is for basic education, education that would enable students to meet challenging conditions. Mr. Watts stressed the pressing need for materials and adequately trained teachers. "Every one of our programs, no matter what subject, what area, is a hollow and meaningless shell if it does not have actual materials for teachers to use."

Dr. Jerrold R. Zacharias then amplified Mr. Watts' comments about the use of materials, pointing out that vocational education begins practically at birth and used as an example of the early use of materials to stimulate interest of children some of the material created by the Elementary Science Study program of Educational Services, Incorporated.

Professor G. H. Cannon, of the University of British Columbia, spoke to the fact that teachers seemed generally concerned with changing detail within an existing framework. They seem to aim at getting more financial support to perpetuate that which is already not doing the job. They want to perpetuate a system that has taken the culture of the past generation and transferred it to a future generation without having given it much thought. He stated that our current educational system began with the goal of caring for the socially and intellectually elite and is based on a highly verbal kind of education. He stressed the fact that those who are not verbally gifted must be given the means of learning without verbal facility and that we must somehow learn to generate the ability to analyze, to synthesize, to evaluate situations, and the ability to apply their intuitive approach to the solution of problems.

Dr. H. R. Beatty, President of Wentworth Institute, pointed out the danger of trying to place young human beings into specific categories, for example, classifying them as those who can develop intuitively and those who have a flair for the abstract. He emphasized that college-bound students have built-in motivation and the others do not. He deplored the general educational program in high schools where students get neither an education nor a salable skill and stated that one principal trouble with vocational education is that students are given a salable skill but no general education.

Following this, Mr. Michael Harris of the Organization for Economic Co-operation and Development in Paris, France, also stressed the need for new curricula and materials and a university that would take seriously the task of training teachers for vocational education. He stated that, in his view, the fundamental weakness of vocational education in the United States is that it has been completely separated from the educational system and objectives as a whole. Professor Frank then raised a number of questions.

1. At what stage of education should one start the development of new curricula and new materials? at elementary school level? at junior high? or at senior high school level?
2. Should we try to merge vocational and general education to provide flexibility for making doing

and learning part of the same educational process?

3. How does one create the ability to grow into new occupations?
4. How do we take into account the increasing dependence of almost every occupation on technical aids?
5. Should we work on problems of post-high school education?
6. How do we give vocational education real status comparable to that of professional education?
7. What is the role of scientific and technical education in any curriculum?
8. Do present programs and practices need overhauling?

Concluding the opening session, Dr. Donald Hopkins, Head of the Metallurgical Department of Swansea Technical College, Wales, England told the Conference that "the purpose of our educational system has got to be that we take each individual and, as it were, by fair means or foul, make him develop to the best of his ability." He noted that the British higher education system outside the universities does not have a "twilight zone" between university and vocational education, but rather the whole spectrum from the craftsman, tradesman, bricklayer to the technician. With regard to the question as to where one must begin, Dr. Hopkins suggested the lowest possible level. "If we do not start at a very early stage, we can allow people, as it were, to go to the devil in their own way, and I do not think we should do that."

Following lunch, the participants met in four subgroups for the afternoon. The purpose of these discussion sessions was to delineate the most promising guide lines that could be followed in the Summer Study. The activities of the first day were concluded with a social hour and dinner at the Hotel Somerset, Boston. The after-dinner speaker was Dr. Vannevar Bush, Honorary Chairman of the Corporation of the Massachusetts Institute of Technology. Dr. Bush spoke to the problem of the obsession of society with the college degree as a status symbol and the need of bringing prestige and recognition of the dignity of non-professional occupations in this nation.

When the conference reconvened on Saturday morning for a general session, the agenda for the day was discussed. It was decided that the smaller discussion groups had been successful and profitable. This pattern was continued but with a regrouping of the conferees into these discussion groups. Dr. H. C. Gunning of the British Columbia Institute of Technology then related to the conference the experiences of Canada with vocational education. Following a spirited discussion, the conferees separated into their sub-groups for the remainder of the morning. After lunch the discussion subgroups met again prior to the final general session.

The final general session was devoted to reports by the chairmen of the working groups summarizing the conclusions of these groups. Transcripts of these reports follow.

FINAL GENERAL SESSION

PROF. FRANK, M.I.T.: We now come to the focal point of these two days. But before we hear from the various groups, I feel that I should make two things clear: First, let me emphasize that in no sense is this enterprise or its projection an M.I.T. venture exclusively. We are concerned on the broadest of fronts with the need to involve people from all the interested areas. We want the best talent that can be obtained anywhere to participate and to help bring some coherence and a common good to all the things that are going on.

Secondly, it has been the support and encouragement of Francis Keppel, the U.S. Commissioner of Education, and his office that have made the conference possible, and that, we hope, will make the continuation possible.

Now, I am going to call for a statement of the findings that the individual groups have made.

Professor Neal Mitchell, Harvard: Our group decided to consider the points that were proposed at the beginning of the conference, and I will try to make a summation of some of the ideas that came up. Let me relate the recommendations of this group to the steering committee, or whoever will run the summer session, as to a basis of operation.

The first point that arose was the level of attack. The general consensus of our group was that the level of attack should be totally broad, from pre-school to university. The comment kept coming out — consider the total picture, consider education on an extremely broad base.

The second question was: "To what extent should all students be involved?" There was a proposal that the ideas of vocational education could be introduced by what we call subversive measures, and that, in fact, many of the things that we are doing now are much akin to what we are talking about. After enough kicking around, it finally came out that we believed all children must have adequate education in manipulative thinking and visual thinking. Obviously this covers a wide spectrum to which we felt this group was in a key position to address itself.

The next idea that came up was an outgrowth of our feeling that the level of attack should be broad and that all students should be involved. We felt that this was the crux of investigative education. We proposed the idea of providing crossovers, as a kind of educational philosophy that would develop a student with flexibility by giving him opportunities for thinking. We felt that perhaps the idea of a crossover was artificial, and that what was needed was a type of open-ended curriculum where students could move through vocational education into various other possibilities. This is what we meant by crossover.

The discussion of stimulating materials came up next. We felt that one has to introduce stimulating materials into a curriculum, but that they must be tried out and carefully evaluated.

We then considered post-high school education. We felt that this level was quite aptly covered but that there was a need to look at education in general here, too. We considered the relation between science and technology, and it was proposed that many of the ideas involved in teaching science were basic to education and basic to thinking.

The question of public opinion and acceptance of vocational education arose. One school of thought felt that public acceptance would be an incidental outcome of a good program. There was a feeling that we should develop the product first and advertise afterwards. Others felt that we must develop new labels for some of these topics. Then there was still another group which felt we should forget about public opinion, that it was unimportant. We ran all the way from saying the summer study should forget all about public opinion to recommending the development of new labels, and, in fact, calling on Madison Avenue to advertise what we were doing. In general, we concluded that public relations should probably vary from type of program to type of program.

The next point we talked about was apprenticeship and cooperative education. We felt that a better area for discussion which should emanate from the summer study was the relation between school and industry. We were careful not to put "university" but "school." We envisioned the total spectrum of the schoolroom related to the total spectrum of requirements, needs and uses in industry.

This immediately sparked another theme of school-to-school relationships. What was the relationship between schools, and how did they co-operate with one another? This led us to a much more important point: what is the relation between school and children?

The next thing that came up was the relation between the school and the parents. Based on our whole series of discussions we felt that the place of the school with respect to the children, the parents and industry

had to be explored and investigated in a summer program.

We discussed the academic and vocational teacher interrelationship, and it became fairly obvious that we were talking about the whole relationship of people with what they were doing.

We discussed something called end-point skills with the assumption that this was a must for the summer session.

Last but not least, we dredged up the thing that everyone felt to be the most important -- the problem of teacher training. We decided that teacher training is a bad word, and we talked about what it is. Finally, we came out with one basic recommendation for the summer people: we want teachers, we want to improve the development of teachers. We feel that there is a desperate need for teachers in the broader sense in vocational education.

And now that I have ended with that word, vocational education, let me come back to the core of everything, which is written in three-inch letters on my notes. We must consider education, we must consider people, we must consider children. We must consider the reality and the excitement and the thrill of introducing children to the broad spectrum of doing and thinking so that they can become part of what we all consider a very exciting society. And this is our challenge to you, Professor Frank, for the summer, and I am sure you can meet it.

Professor Frank, M.I.T.: I don't think any of us can quarrel with these objectives, and, since they have been presented in such sweeping terms with such an enormously broad objective, I would like to inject myself to report very briefly the considerations that we went through in our group. We were concerned very much with the last point that Neal made: the relation of education to doing; the sociological needs, the ultimate aim to achieve social and economic results that are worth the effort.

I must say that, perhaps due to my own preconceived notions, I felt that to get on with this job we should set our sights for the initial attack (not denying anything that came out of Mitchell's group) on a rather more limited first step. I think there was agreement in our group that one should focus sharply on the problem of rates of change of foreseeable skills, what people will need to work happily and gainfully in society. Those somehow must be studied in terms of what they dictate as requirements for sound education for the youngster who is growing up.

It was proposed that the initial step, because all levels depend so critically on a base, should start early and focus the first attack at a manageable point. In essence, we felt that we already had a lead on the problem, in the sense that good things have started in elementary school education. These give us an attitude which is compatible and consistent with the broader goals, and perhaps we could most effectively start at the junior high school level. Here may be the place to create something to aim at filling the broad gap between the specialized vocational track on the one side and the limited college curriculum on the other.

This is part of the spectrum presented by Professor Mitchell and it may be that we will have to limit our initial attack to something that will move fast, rather than trying to do the whole thing.

The sense of our meeting also was that it was essential to develop a two-pronged attack in a summer study: one, on the immediate needs which cannot wait for a whole new generation of youngsters. These are the critical problems of our society; the problem of dropouts, the problem of those youngsters and adolescents who have been rejected from the one pattern of college preparation. We should work on a dual program which couples together one approach aimed at doing something for the more immediate problem, and the other attacking the fundamental question of a recasting of all education. This latter must try to fill in the great gap that exists now between the opportunities for some children and the lack of opportunities for another large fraction of our youngsters.

The problem of teacher education is recognized as being not only important but critical, but I think we felt that efforts in this direction should be an integral part of developing the new materials.

As materials become available, we should follow the pattern, that seems to work so well, of moving them right into schools on a trial basis, and finding out from frank evaluation what these materials lack. We should involve people who are concerned with the impact of what we are trying to do sociologically and economically as well as in terms of the substantive improvement in the understanding that develops in the youngster.

We also agreed that the sort of curriculum development we should aim for would be one in which great emphasis was laid on developing manipulative skills accompanied by an equally strong attempt to use these as the means of creating significant understanding. Unless the whole spectrum of understanding involves flexibility, the ability to grow is placed in jeopardy.

Professor Robert Mann, M.I.T.: Perhaps our orientation may be a little different, as we tended to look more from the point of view of the child and the consequences of his education in terms of his occupational future, rather than the problem of manning an industrial nation. We argued that first there is an essential need for early and sustained infusion into every child's education of expression and experience in sense-oriented activities as contrasted with symbol-oriented elements. Sense and symbol have a number of other polarities that go with them. Sense could be manipulative, non-verbal, perceptual, manual, aesthetic. Symbol could be mind, verbal, mathematical, etc. We recognize the privilege that we pass on to the summer workshop – the problem of delineating appropriate areas in which these sense-oriented activities can be developed.

A great many possible alternatives were suggested running from cafeterias to model airplanes to hot rods to field trips, a long list. It was recognized that these kinds of activity, as contrasted to measurable knowledge or acquisition of experiences, have a great intransigency to measurement. This is perhaps one of the reasons why they have been looked upon as less important by the most important element in the whole discussion – the child himself. The child obviously does have some exposure to this class of activities in the elementary schools now, but why shouldn't he (as I am sure your children do) consider them as fun things but not really as important as arithmetic, social studies or history. This is one of the problems; this problem of measuring that which is intransigent to measurement.

We feel that, in addition to this infusion of sense activity, there needs to be far more experimental learning to supplement the more subtle transferred knowledge which takes up the larger part of our educational process at the present time. This might take the form of project-oriented as contrasted with subject-oriented curricula. Again, some of these same project topics which were cited with respect to sense education are appropriate – cafeteria, school itself, classroom as social and cultural entities – all represent the means by which the student could derive experiential learning through his own involvement in certain situations.

There was a strong sense throughout my group that the educational process had a shared responsibility for developing and sustaining social and ethical values on the part of the student, and it was pointed out that this kind of experiential learning provides a marvelous format in which to exercise the student's indentification. I think of such things as self-discipline, intellectual honesty, and various other attributes which are essential to effective employment in later life. (The last two topics should infuse all education.)

As we proceeded through the education of the child up to times when there is a need for making decisions as to the probable career for each child, the varied experience in the sense-oriented and involvement kind of situations has provided him with better information. He has had better opportunities for self identification and self determination in selecting vocational areas, rather than having them imposed upon him as a consequence of his inability to manage the elements of the current educational scheme.

At this stage, it seems appropriate, possibly for all children, to introduce into the curriculum a coagulation of materials, processes, information common to large areas, large groups of vocational opportunities. Clearly this is an area which requires a good deal more research to build a system of predicting – of attempting to foresee – job opportunities, five, ten, twenty years ahead. Then one must attempt to define the fundamental characteristics of effectiveness in these large areas of human activity and introduce the curricular materials which would begin to acquaint the students with these potential areas of career orientation.

At this stage, the child is beginning to make decisions which send him along several alternative tracks in respect to his post-high school and career opportunities. For those children to whom the high school or technical high school or community college represent a terminal schooling (in the sense that the school experience terminates and the job opportunity commences) the school has a responsibility to provide first employment training so the child can move into employment opportunity with no further training.

Implicit in these goals, of course, are research and the development of a good deal of material. The problem of teacher training itself (call it training, call it re-education, call it whatever you like) is a matter of involving teachers in the development of these educational processes so that they are at ease, confident, and capable of involving themselves with their students in these kinds of learning processes. It was pointed out that not only do teachers need this kind of re-education but administrators, guidance counselors, the whole educational complex of the staff that comes in contact with the student needs to be informed. They need to be actually involved; a patronizing attitude is absolutely inappropriate. The teachers, guidance counselors, superintendents, adminis-

trators, have to be part of this process by which these developments come into existence.

It was pointed out that the development of new material, the development of curricular guides, project units, and the development of teachers, is an on-going and indefinite process that cannot be looked upon as some single change. Rather, this is a process which must go on in an indefinite way and, in fact, this is a research constituent of a total educational process. It was observed that in engineering science – to a very large extent – research keeps the engineering scientist honest. He knows that if he relies too heavily upon his own knowledge of the status quo, he runs the risk of having research very rapidly deflate his position by the emergence of techniques, abilities or alternatives which make his store of knowledge no longer saleable. In the same sense, the R & D programs which we are talking about here, of teacher development, of material development, of curricular evolution, constitute a research ingredient in the evaluation of the process itself, because the research activity, as it must be carried on with teachers and with students, provides itself with the feedback as to the effectiveness of the programs which are being explored. Now, this feedback, is, of course, extended, and needs to be extended, not only among students and teachers, but it has to encompass the community and the society, which after all are the supporters and the beneficiaries of the educational process. This gets us into the broad realm of sociological and economic relevance of the entire process: of the public relations, of the mutual education of citizens, of a community, of a society, of the government. Education is a very important business and one in which we are all involved and which demands a very large part of our total effort and ability.

Many other ideas, of course, played through our discussion which I have not belabored. The educational process is obviously not a single step – it is a flexible, open-ended process which provides mobility for the student in a variety of ways and encompasses not only the school but the community outside. The need for communication inter schools is the kind of process we are talking about; it implies that the junior high talks to the high, the high school talks to the college, and within the schools these kinds of teachers talk to those kinds of teachers. Dialogue is what we are talking about these days: dialogue takes place in multi-dimensional ways through all the ingredients of this process.

It was pointed out, perhaps not explicitly, that we do not want to end this workshop without a real, concrete, current knowledge of the employment situation in the country. We must make every effort to recruit people who are involved on a continuing basis in attempting to project over the long term what the employment possibilities will be.

There is explicit in everything that I have said a variety of "bifocalities:" there are on the one hand long term problems; there is on another hand a bifocal distribution which has as one center the college student and the other center the terminal high school student. There is another set of distributions which has at one hand the otherwise normal, emotionally-adjusted child and at the other end the abnormal or deprivational type of child. These kinds of considerations have to be woven through all the other topics that have been described here in order that the attack be genuinely comprehensive and of ultimate benefit to all of the users, because, after all, we are all children, parents, teachers, taxpayers, etc.

Wallace Fletcher, Newton: Our group, apart from covering everything that everyone else covered also investigated what some of us feel are more fundamental areas. One of the key questions raised in our group which we pass on to the summer group was the involvement of the child with the work world and the community around him. We felt that a corollary of this was people other than professional teachers being involved in the schools with the children and with the teachers at those times which were appropriate.

It was pointed out to us that the school systems as they exist today are essentially custodial institutions with an inmate problem and, obviously, some of the inmates have skipped. What we have to do is to break open the walls and make it a creative act for some of the kids to move out: some of them perhaps to stay out for a while and then come back.

We felt that the matter of team teaching in the broad sense should be given real consideration by the summer study, and we felt that we, as perhaps the other groups did, too, placed insufficient emphasis on the role of the guidance counselor in the educational process. Particularly, there may be insufficient consideration for the role of the vocational guidance counselor in the educational process. The implication is that it is extremely difficult for a young child, who has no understanding of the world of work around him, to make any kind of intelligent choice as to the type of vocation which he might wish to undertake. As a result he lacks the kind of information which should be available when he makes that choice. The whole area of occupational information, occupational understanding has to be explored.

We felt, too, that the segregation of school systems militates against this ideal. We, by implication, would like the summer group to consider the advantages and disadvantages of crossing district lines with schools and with children. For example, the children of a city such as Newton with 216 out of 20,000 students who are Negro might have the opportunity of working with some schools in Brighton, Waltham and Somerville, and sharing the value judgments and the experiences of both populations. The world in which the Negro child is growing up is one in which the Somerville child does live and in which the Roxbury child does live, with whom he will have to work at some point in time, so he has to get to know him. Also, we feel that cross fertilization between the teaching staffs of these systems, with the leaven of the bread being the outsider, would have much value.

Professor Frank, M.I.T.: It does seem that, very gratifyingly, in spite of the wide diversity of interests, experiences and backgrounds of this group we have got a common base on which we can start to sharpen our swords and attack this very important problem. One of the things that we have got to do is to make this national — we must have a national committee of some sort. This operation must extend and work cohesively with the whole country, not be simply an isolated operation which works by itself and hopes to be powerful enough to influence everybody else — but from a distance. Now, one of the things we are going to need is participation in this summer effort. We will welcome participation, part-time or full time, of all sorts, and now I would like to ask for comments.

Comment: In our last session, we developed the concept that vocational education and general education should not be severely separated. Most of us seemed to agree that the child's early education should encompass the full range from manipulative to verbal skills, and that what separation and emphasis existed for any particular child would depend upon how he reacted to these two kinds of stimulation. Therefore, in the course of going from kindergarten through 12th grade one would find a number of different streams depending upon what particular manipulative skills as against verbal skills particular children showed. And, there would be no real demarcation between vocational and general education but there would be a spectrum on the one side leading definitely into vocation and on the other side leading definitely into verbal, with possibly somewhere near the end the youngster making a decision as to where he should really put his emphasis.

Professor Frank: I sense that in all of the discussions there is agreement about the need for multiplicity of opportunities for maximum flexibility so each youngster as an individual has a chance to grow in a pattern as nearly suited to his talents and capabilities as possible. So, certainly, in the broad terms, I think there is great agreement. The task of the summer effort is to start to give these ideas form and shape and to make them of sufficient size and impact so they can grow and start to cope with these great problems we have.

TRANSCRIPTS OF TALKS

The following are based on tape transcriptions of informal talks; they have been edited by the staff of the Science Teaching Center.

DR. KILLIAN:

MAY I say we are immensely delighted to see this group from the United States, from France and from England, representing all aspects of the topic which we are going to discuss.

Several people have said to me this morning that they were surprised M.I.T. would be interested in vocational education. Was this not something new for M.I.T.? Actually, it is not something new. One of you, Mr. Watts from Colorado, wrote me a letter several months ago, reminding me that a former president of M.I.T. back in the 1870's had been one of the key figures in launching mechanic arts education in this country. He had gone to the centennial exposition in Philadelphia and had seen some of the foreign exhibits, notably a Russian exhibit which dealt with mechanic arts education. Having been inspired by the exhibit, he returned to M.I.T. and established a school of mechanic arts. Mr. Watts called my attention to this and asked what M.I.T. was doing about vocational education now, having been involved back in those days.

This came almost concurrently with a visit I had from Senator Harrington, the Chairman of the Commission on Education in the Commonwealth of Massachusetts. He was accompanied by Dr. Paul Marsh. They said that in the course of their research, they had been looking at vocational education in this State. They were convinced that there was an opportunity to take a fresh look at the content of vocational education, and asked if M.I.T. would consider trying to bring together a group to take this look. This was just a validation of what Mr. Watts had written to me on the matter.

Concurrent with that also, President Stratton had been attending a meeting of the Advisory Committee on Vocational Education called by the Commissioner of Education, Francis Keppel. Commissioner Keppel had indicated his strong conviction that there was an opportunity for representative groups to come together to take a fresh look at vocational education and that the Office of Education had funds made available by Congress for research in this field. It was a confluence of these different events that made clear the opportunity which existed to take a fresh look. After hearing these different reports and suggestions made to us, we at M.I.T. began to talk within our own community and found a great enthusiasm and interest among faculty members in this field of vocational education. So here we are. We are proud to be a part of this developing activity, because we think it is enormously timely and relevant to the kind of education about which we are concerned. We have been, as you know, thanks to Professor Zacharias, Professor Frank, and many others, involved in the development of new programs in the teaching of science – the PSSC, for example. Having been involved in these programs simply reinforces our conviction that vocational education as well as the preparation of better curriculum materials, new approaches to the teaching of science at the high school, college and the elementary levels, need thorough examination. All of this is of the same piece, with no part being more important than another. Vocational education is an essential part of this total revolution of upgrading and developing more imaginative approaches to the teaching process in every field.

I would like to say to you in welcoming you here that we are convinced of the importance of this as a part of the seamless web of education. We are hopeful that this group will lay the plans for a first rate program this summer, that this program will be devoted not only to mechanic arts but to every aspect of vocational education, in content, sense and at all levels of vocational education. I do not want to try to set any guide lines here. I am just expressing my personal vote that you will have a hard look at the pre-college vocational education and at the post-college vocational education, too, in all of its aspects. Given the temper and the spirit of the times, given the fact that there is an innovative spirit running in education today in America and in other countries, we have an outstanding opportunity to do something that will be of long term significance in taking a new look at this important field. We are very hopeful that this will be a milestone in vocational education. Thank you very much for being here.

DR. ARNOLD:

I WOULD like to express our very deep appreciation to you, Professor Frank, Dr. Killian, and others for your thoughtfulness in putting this conference together and getting such a distinguished group from far and wide to discuss the problems of vocational education and education in general. I ought to point out that Dr. Stratton is a member of the National Advisory Committee for Vocational Education, which is established under the new act. He has been very helpful to the Commissioner, our staff and others in giving advice and consultation on many problems which confront the new programs.

The federally aided programs in vocational education are built on a rather strong federal-state-local structural relationship. This is not to exclude the institutions of higher education that are and have been for years quite active all over the country in the preparation of teachers, supervisors and other leaders in vocational and technical education. The institutions of higher education have been very active and very helpful in the programming of technical education, especially on the post-high school level. It is perhaps not obvious or visible to all of us that some of the changes and new directions in vocational technical education did not arise in the immediate past. I think they could have been detected about ten years ago, beginning with the Health Amendments Act of 1956, which provided for training in the health occupations with an ear-marked appropriation. Here was a recognition of a whole new field of training and need, and a piece of legislation which departed from the traditional limitations that we find in the older acts – the Smith-Hughes and George Barden Acts. There were no time requirements and it was confined to the health occupations with emphasis on practical nurses. Nevertheless, the Act opened the direction that vocational education would take.

The next step occurred two years later in the tidal wave of a National Defense Education Act where there was provision for the training of so-called highly skilled technicians in occupations necessary for the national defense. Here again there were no time requirements.

The law called for an emphasis on science and mathematics in connection with these highly skilled technician jobs and the training for them, but no reference was made to a particular occupational category as was traditional in vocational education. Then, following the National Defense Education Act, came the first special attention of the Congress to the training of unemployed persons in so-called depressed areas. This came through the Area Redevelopment Act in 1961 and immediately after that through the Manpower Development Training Act which was really an expansion of the retraining program under ARA. These were a succession of provisions by the Congress to treat the training problems of employers and of people in this country without the traditional limitations and restrictions that prevailed in previous legislation.

Immediately following the Manpower Development Training Act came the Vocational Education Act of 1963. This Act opened wide the use of federal, state and local matching funds for all kinds of occupations, for training of persons of all levels of ability in all kinds of institutions. The Vocational Education Act sets the stage for this kind of conference because it is quite obvious that we do not need to concern ourselves chiefly with limiting regulations and legal provisions.

Concurrent with these Acts are the Economic Opportunities Act and the very sharp amendments and changes in the Manpower Development Training Act. I would suggest to those of you who have not seen these yet that you take a very close look at the amendments that have just been signed by the President. They are almost revolutionary in the Manpower Development Training Act. The Economic Opportunities Act, the Appalachia Act, the agricultural legislation and many other pieces of legislation, in export, import, and trade, are all concerned with training.

All of these pieces of legislation at the federal level appear to me to be a kind of exploration on the part of the Congress and the Executive toward developing some kind of meaningful manpower policy in this country. To support this idea, there are many things going on inside the Executive Department of government that are not visible to many of us. Included in these are exploring how you gather meaningful information on a national basis, what kinds of information have to be made available, and what interpretations can be made of this information that will be helpful in program planning, and doing some innovative work in this whole field.

We have challenged people to suggest something in the way of vocational and technical education which cannot be done under all this legislation. Since we have not found anything yet, the door is wide open. Certainly the advent of the research program, the provision in the new Act that ten percent of each annual appropriation shall be devoted to research in vocational and technical education, opens the door to innovative ex-

perimental demonstration types of activities that we have never been able to carry on before.

The changes, development, expansion and improvement of vocational and technical education is very dramatic in the states and in certain large cities across this country. Some of this has been done under the preliminary stimulation of the new Vocational Education Act. But we have to take hold of ourselves at the federal level and realize that there are many people across this country that have long since been ahead of the federal government in these matters. You see many illustrations of this. Just this morning, the press release went out approving the experimental program in vocational education in Quincy, Massachusetts. This will be watched with great interest, and is illustrative of the kinds of things that are happening throughout the states.

Our official position at the federal level has been aiming toward what we are calling a total balanced program of vocational education. We are talking primarily from the state viewpoint right now but there obviously is a need to take a look at interstate and regional or huge labor market area problems.

North Carolina, for example, is in a very advanced stage of developing a very effective total balanced program of vocational and technical education. You see twenty industrial education centers coupled up with comprehensive community colleges giving a wide range of training for persons of all levels of ability, right on through to high technical job training. Of course, concurrent with this is an improvement in the whole elementary and secondary school programs. There is considerable investment being made in the secondary schools in North Carolina. This moves on into the institutions of higher education. But I do not happen to know of one state that has taken the total look and the total approach to their education problems the way North Carolina has.

Now, in this meeting we are all going to be concerned with certain issues and problems; and knowing many of you, I know we are going to differ from time to time in point of view. I hope the differences will be more in the way we say it than in what we actually mean. It occurred to me that if we can keep this very erudite group's minds open and moving with ideas, we will come out with something very fruitful. This is a unique experience for many of us to see a genuine interest on the part of people from many different interests and activities, coming together to discuss some of these problems.

I jotted down a few things that are as old, I guess, as any of us, but they are problems that are being discussed very thoroughly in Washington by various committee groups that are indeed interested in the issues and the problems and solutions. For example, one of the critical problems the President's Committee on Specialized Personnel just last week addressed itself to is: How do we bring meaningful information to young people and adults as well about the world of work? What makes America tick in terms of industry and business, and in terms of jobs? We obviously have not even touched the surface on how to do this. As one business man put it, how do we bring the employer (user) closer to the student (product of the public schools or the schools of the country)? We have not learned how to do this and this business man observed that we have so many layers of insulation between the user and the product that we do not do a very effective job for young people in acquainting them with the world of work in this country or even in their local communities.

So we have this whole range of problems. How do you reach young people with meaningful information to assist them? How can we utilize, extend, or improve the existing guidance structure in the schools of America? Another very basic social problem, and I will be interested in hearing some of the social scientists here discuss this at some point, is how can we bring some reasonable degree of social prestige to and status to the non-professional occupations in this country, in the light of the status which the professional jobs hold in the minds of parents and people?

I have talked in the last five years to just a couple of sociologists who have been interested in getting at this problem of how we can help rural youth particularly adapt themselves to an urban, industrialized society. Most of our trained technical and vocational teachers have not concerned themselves with the problems that a young person has migrating from a rural environment to an urban or industrialized environment. This is a very serious problem in the public schools in this country and you all well know of the great migration that continues to take place into the urban centers.

I think we are going to address ourselves especially to such problems as what kinds of curricula will best serve youths and adults in the light of their abilities, interests and aptitudes. How specialized should vocational and technical training be and when should it begin? How should this best be carried on? What kinds of institutions and at what educational levels can vocational, technical education be most effective? I have the feeling that we tend to oversimplify this problem. We

have a tendency to talk about some beautiful pattern which we might be able to develop that everybody might come through and at some time be very readily adaptable to the changes that are occurring in our society. If we can do that, we are a lot smarter than I think we are. What methods or techniques will best serve to equip a person for a rapidly changing work situation? In our research program, we are becoming very much concerned with the use of the computer and programmed instruction and some of the more sophisticated developments in this field. This kind of thing may have a very great impact on the whole program.

In conclusion, it seems to me we have the tools and the means to deal with many of these and other problems. We have ample research money. We have all of the provisions that we need. I think we have the intelligence, and this meeting is an expression of the interest and concern with the program and problems. The test now is of our imagination, our initiative, our aggressiveness, our willingness to explore and experiment and demonstrate and still keep our eye on the ball to produce what it is that all of this legislation we are dealing with expects us to produce.

I am not sure how many of you are aware of this, but we are extremely conscious of this at the federal level. The new Vocational Education Act has built-in provisions for evaluation of the program. The law requires that at intervals of no longer than every five years, the programs across the country shall be evaluated by an ad hoc group to be appointed by the Commissioner with the approval of the Secretary. The money is in next year's budget to appoint the first group of twelve persons. I believe that this group will be appointed probably sometime late summer or fall. The law requires that this first group report back to the Secretary and President and the Congress by January 1, 1968. That is a very short time. They will certainly be involved for at least a year, as the previous panel of consultants was involved, in the study of the program. We are trying to set the stage in our office through reorganization of our division. I might say that we have here with us, among many other staff members, Mr. Bernard Michael, whom we stole from the Department of Labor. He is a labor economist who is working with me in examining the direction the program is taking and giving consultation in the directions it should take. He will be accompanied by a sociologist as soon as we can get one. We expect that Mr. Michael and some of the rest of us will be the direct liaison for this newly appointed evaluation group. But the real point is that there is going to be a very searching examination made of what has developed not only out of the Vocational Education Act but the other pieces of legislation that have to do with the training of people for occupations other than the professions. We look upon this as a very severe test of everything that we are thinking about, that we are doing, and that the states and institutions are doing. With that note, I would like again to express our appreciation especially to this group for addressing themselves to these problems. Thank you.

MR. WATTS: WE ARE on the using end in the public schools in Jefferson County, Colorado. I come from a district that is about 1,000 square miles in size. We have urban, suburban and rural people. A mixture of the people is moving in rather rapidly. We have an increase of approximately 5,000 students each year.

I want to tell you of a situation that I think we ought to talk about early in the game. We can talk about plans to do things and problems that arise, but unless one looks at the user end, the rest is going to be a little time-wasting.

Let me talk, as an assistant superintendent of schools, about something I felt very strongly about as I got on the plane to come here. I know what Dr. Arnold's position is. An administrator at the top level can have the best plans in the world, but at the using level, the classroom and student level, you will not recognize them. Here is the situation as we see it.

Too much of the 1963 funds are pouring down the same rat holes without the needed increase in quality. There is too much reshuffling of existing plans, too little innovation, and too much use of existing channels without opening up to the wide frame. I will describe our situation in Jefferson County and you people can make your own interpretations.

In 1958, we began the Physical Science Study Committee course in one school. In 1959, we began our own

in-service training in this physics. It opened a new world in education. By 1960, we had all the schools, all the teachers, all the high schools working on this. We were thrilled with what we saw; so we began the School Mathematics Study Group mathematics, the so-called new math. By 1960-61, we had all schools—7th, 8th and 9th grades, some 35,000 youngsters, working on this. Then we did the BSCS in biology in 1960. By 1962, we were using it with 95% of all the youngsters in the schools and had all the teachers in all the schools retrained. We did the Elementary Science Study, with eighty-three teachers last year, 165 teachers this year trained in some portion of these units. We did the Introductory Physical Science program with eight junior high schools; the Earth Science Curriculum Project at the University of Colorado, geology, and so forth. Each of these units allowed us to find out something about youngsters.

First of all, youngsters can do a lot more if they have the materials and the trained teachers. The new product, the new youngster is going out. He is asking questions and he is not satisfied if he does not like what he sees. Our vocational education has been dropping off very rapidly as we have tried to pump money into it, in materials and in people. We found as we worked on the matter of a foreign language that we could easily put in seven years of Russian, French, German and Spanish starting with grade seven. It is no trouble at all for these youngsters to learn to speak like natives after three to six months. And we used the ESI and the Amherst social studies, our youngsters showed a sudden insistence on more and more inquiry.

We looked at all teachers in vocational education. We found that they had less than ten hours of mathematics at the college level, less than five hours of good college science. Something was wrong, we were not getting the highest quality. So, we went to every university in the five state region, not just Colorado. Here we found that the vocational education people at the university do not talk to the industrial arts people at the state teachers colleges. We hire both these teachers for vocational or industrial arts. They do not talk to each other, so we said, let's start talking. We had statewide meetings.

We discovered that the Colorado State University is an excellent one. It does not take a back seat at all. It has trained all of the five teachers trained for electronics teaching in the past seven years. But they were teaching better and better in the trades. So, we went to the labor and advisory councils. We could fill the slot, talking in football terms, of all the technicians and all the tradesmen that they could possibly turn out if they would allow us to take them in one school, let alone the State.

We went a little further on this. We wanted, first of all, to give a basic education, a general education, as you may call it. Various studies, the Columbia for example, have shown that we do not tell the youngsters where they are going when they leave, whether they go to college or otherwise. We advise them, but we do not predetermine what they are going to do. However, if we let them elect the vocational education options we now have, we have determined that they cannot go on except within a very narrow range. If our need is to train these youngsters with a basic education which will enable them to meet the changing conditions in the changing work-world, we must ask ourselves what the work-world is: let us get out and bring people in. We have to get out of this common rut. The youngsters did not have a basic undertsanding. They were not able to think on their feet with a new situation, to ask questions, and to pursue their own motivation. They were essentially dead and every employer told us this.

We looked at the subjects, mathematics, English, and the various basic ones. There was not one vocational education subject that taught this sort of thing.

We could not find a vocational supervisor. We like to deal with this education as an open system. We will go anywhere in the country if the people have something worthwhile. We went through every kind of recommendations. Some of these gentlemen are representing institutions that helped us. We tried for a Ph.D.; we tried for the master's level; we tried for business. We ended up with a vocational supervisor from the Air Force, working in technician training, who did not have even an A.B. degree. But he was interested in getting out and changing the world. He was working there on the frontier.

I know, with the United States Office of Education, with the money and so forth, that it is a wonderful day for vocational education. But, unless we have a new look, we are wasting our time. Every one of our programs, no matter what level, what subject, what area, is a hollow and meaningless shell if it does not have actual materials for teachers to use. Unless we start back at the teaching materials level, there is no reason to talk about the things that come later.

I want to illustrate one other thing. We had a 1963 art research and development project proposal. We proposed to start at grade eight with every youngster taking

some basic technology. We wanted to give them a basic spectrum of skills. These youngsters had gone through the School Mathematics Study. They were not content to go in and make a matchbox or polish a piece of wood. There is not an iota of studying in any of the vocational courses that is a challenge for a good, average youngster. We were told these courses are a dumping ground. I cannot believe this. Vocational education is too important.

We have been able to offer vocational education, or pre-vocation, if you will, to all eighth graders and the boys were most enthusiastic. We had to hire people from industry to come in. We did wonderfully.

We needed a bond issue to expand the facilities. We went to trailers. We hired trailers like industry does. We rip the guts out of these things and put in anything that we can that will do the job and move them from school to school. On the State level, we went to the vocational education people. They said, that isn't exactly according to the State plan. We replied that it was not according to the *existing* State plan. I found out from Dr. Bushnell that there were four days remaining before the deadline to submit a research and development project. We stayed up all night and made it.

We are operating a vocational education program to the best of our ability, making all the materials that we can. (You do not make local materials, you reshuffle them.) We have trailers that we are moving from place to place. I would like to start working on air drops, movable-by-air classrooms to meet whatever changes are needed. We can meet the need for facilities. We can provide any kind of implementation for bright, eager youngsters. However, we do not have a program; we do not have materials. We have got to break out of the common rut. Now, this is what I would take to be the whole mission of this vocational education planning conference.

MR. HARRIS:

I AM not going to say much about what we are doing in the Organization for Economic Cooperation and Development in this field. I would rather talk about the problems that you are discussing here today, because I think that they are similar to the problems that exist in Europe and in all of the member governments which belong to the OECD.

I would like to say that I am delighted at the chance to come here and I am intrigued by the idea of M.I.T. holding a conference on vocational education. I had two questions when I got your invitation. The first was: what is M.I.T. doing in the field of vocational education? The answer to that came very quickly – M.I.T. is, after all, one of our finer vocational schools. The second question was: what could M.I.T. do about vocational education? That is related to a period in which I did a little work in the field myself for the Ford Foundation, and I reached the conclusion then that the important thing to be done in vocational education was to look at the quality of it. I thought that quantity was a problem that would ultimately be resolved by congressional appropriations and by general acceptance of the need to increase the quantity of vocational education.

I think that one of the real problems today is the fact that the federal government has appropriated a great deal of money. The money is there but we still have the same problems: what is to be taught? where is it to be taught? how is it to be taught? and who is to teach it? Where do you get the teachers? Those are the problems that have faced us in vocational education for a long time.

I must confess that I think it is wrong to look at vocational education from the point of view of job preparation, or the teaching of specific skills. I do not see anything morally wrong or educationally wrong with that, but I do not think this point of view rests on a factual basis. In the first place, I come from an organization which is outstanding in the field of forecasting economic developments in its member countries. We do, in addition, a great deal of work trying to forecast the development of occupational skills. When I worked in the field of vocational education, I heard many vocational educators say, if the forecasters could simply tell us what jobs there will be five years from now (this was partly in answer to the question of obsolescence) we would know how to train people for those jobs. The fact is that no one can forecast jobs in that detail. Nor can anyone forecast the content of those jobs in detail. Furthermore, the probability is that by the time you

train students for those jobs, the jobs themselves would so change in nature that the students would need a great deal of additional training after the initial training period was over. Moreover, the problems of vocational education are not exclusively those of preparing people who cannot get jobs. Europe has an extensive system of vocational education, good and bad, but Europe is suffering from anything but unemployment. Rather, the problem is full employment. In Europe they are concerned with problems of vocational education because vocational education is much more than training people for jobs.

I think that the fundamental weakness of the vocational system in the United States is that vocational education has been completely separated from the educational system as a whole and from educational objectives as a whole, in terms of its institutional setting even down to such things as the relationship of vocational educators to general educators. In this regard, I think that vocational educators, general educators and others are equally at fault.

I visited a vocational school in Chicago, and I went to the Faculty lunchroom at lunch time. It was arranged in a horseshoe, and the only seats open when we walked in were in the middle of the horseshoe. After some of the faculty left, we were told that in this school the academic teachers, the teachers of academic subjects, sit on one side and the teachers of vocational education sit on the other. I thought it was symbolic of the fact that vocational education and general education have been (to the derogation of both) completely divorced each from the other.

I think that what M.I.T. might be able to do in a conference of this sort is to begin to think about the position of vocational education as an instrument of education in general and as an essential and vital part of the educational process. In that respect, I agree with what was said earlier, that the problems of vocational education are essentially those that face educators in any subject.

At what age level do you start teaching vocational education? If you look at it only as a problem of training people for jobs, then you probably ought to start after high school or at the latter part of the high school period. But if you look at it as something that has an educational value in itself, then some of the things that can be done by vocational education ought to be done at a very young age indeed. Some of the people who are less verbally gifted or who do not look at things from an abstract point of view, can learn by some of the very same techniques that are used in vocational education. They can learn more and they can learn much more quickly.

I think that one of the essential things is to regard vocational education not as vocational education alone but as part of the educational structure. This would mean that general educators would have to give up some of their sacred views about vocational educators, or, to put it in other terms (not being an educator, I may not use the proper terms), give up some of their views about specific education. They must relinquish some of their views about the use of tools in teaching, and some of their views about preparing people for specific occupations at certain stages in their careers.

Vocational educators also will have to come to look at vocational education in terms of what it does for the child. I think the distinction between vocational and general education is a completely false one, because we are concerned with the children, not the jobs. We cannot tell what a child is going to be like at the age of ten, twelve, fourteen, even sixteen. We are concerned with children and the problem is how to give each child the best possible education that we can give him in the school. This will mean that education will consist of a certain complex of subjects for some and for others, a different complex with different weights given to the subjects. All students should learn something about the world in which they are going to live. For all students, some of the vocational techniques will be better than some of the techniques that are used in general education. And the child who is bound for vocational education ought not to be deprived of the subjects which now make up general education, although he may get a different mixture. He is going to need these subjects and we are after all interested in the child himself and in his ability to get on in the world of work.

To do this, we need some institutions to train teachers. Where do you train the vocational teacher of today? What university in the United States really takes seriously the job of training teachers for vocational education? We need to do something about teaching regulations and this whole hierarchical system of qualifications for teachers, which obviously does not work in the field of vocational education. By definition, the schools of education, which do not recognize some of the subject matter that vocational teachers teach, will not train the teachers. Nor will they give them the necessary certificates and consequently we have an enormous problem in training teachers. We need curricula. We need materials. We need curriculum development centers. We need to do a great deal in the area of curriculum development. I know that the Office of Education has done

a lot, but I think that much of it is too vocationally oriented. It looks too much like training for specific skills. The curriculum ought to be revised in terms of how vocational education fits into the whole educational structure and pattern. Similarly, materials and teacher training should be revised in terms of the whole educational structure.

I think that if institutions like M.I.T. would become interested in these problems, it would mean an enormous amount. It would answer to some extent this question of the prestige of vocational education. There are very few, if any, of the great American universities that have the slightest interest in vocational education. This works in two ways: it affects the prestige of vocational education and it also means that vocational education does not get the advantage of the experience and of the knowledge of the great universities of the United States. Some of this, I think, has come from an intellectual snobbishness on the part of the great universities. It is an intellectual snobbishness that does not rest on fact. The universities are quite content to build up fine vocational schools in medicine or law and yet sneer at vocational education in its other aspects. This has had a very sad effect on vocational education in the United States.

Whatever the reasons for this separateness of vocational education from the whole of education, I think that this is the thing the great universities should dedicate themselves to and exert their influence on. If this separation were broken down, it would make a vast difference in the quality of vocational education and in the quality of the education we would be giving to the whole of the student body.

MR. HOPKINS:

I WOULD like to say how pleased I am to be here. I was in this city some five years ago, and I enjoyed it very much. This totally unexpected invitation to come again was received with very great pleasure, particularly since the reason for which we meet is this subject.

There is to some extent a misconception as to the degree we have concentrated in Britain on education of an elite. We had a very small university population relative to the total population, I know, but what is or has not been realized is that we have a vocational education system. I call it vocational for the moment because it is a common item of vocabulary. We have had our vocational education system with a population twenty times as great as the university population. It has been increasing over the last five years at a rate at least as great as the university increase.

I was very much interested to hear a question on what has been called the 'twilight zone' between university and vocational education. I think that this will represent one of the problems you will have to face. In the British higher educational system outside universities, we have the whole spectrum from what we call the craftsman, the tradesman, the plumber, the bricklayer, and so on. If any of you have come across the Robbins Report on Higher Education in Britain, you will know that we have in the technical colleges courses which are of full university standard. So we do not have this twilight zone. I think if the program which comes out of this reconsideration raises the level of education given for vocational purposes, you will have the problem of what to do with those who develop somewhat later than usual, or slower, whichever way you care to put it, but then do appear to be capable of attaining the highest professional and academic standards. Your program is going to have to have some flexibility in it.

We had one review about 1956, and another about 1960-1961, and we are going at it again, simply because our thinking has been forced to change by the changes in industry, commerce, and so on. We just cannot staff our upper levels of scientific industry unless we turn around and make the best of every individual. The purpose of our education system has got to be to take each individual, and make him develop to the best of his ability. If he is going to be a good plumber, then I think our whole western society has failed in some respect unless we evoke this response from him because he is made to feel that he is doing something which is the best thing he can do. I think that we have got to get across somehow the idea that if a young man chooses to do something which is not of the highest academic status – because it is the thing which he can do best – we must encourage him in this choice.

In our system, as a result of this technical college-

university overlap in level of courses, we do have quite a considerable flexibility which has only been accepted generally over the last five years or so. We have had this intellectual snobbery. We have had people sitting on other sides of a horseshoe – different sides of a room – different rooms of a building. But something happened about 1960, some kind of ferment got going, and I think it got going very largely because industry turned around and said that the technical college product was coming into industry with an idea of doing a job, whereas too many of the British university outputs are not.

As the Chairman of a steel company in Wales, which is a small company relative to the list which I see in *Fortune* but is one of our larger ones, said: "One of my problems about taking some kinds of graduates in is that they want an office, they want assistants to do their work for them, they want to make a discovery once a fortnight, and they want to be on the board in five years – I am sorry, two years. I am a young man and I am damned if I am going to move out. As a result of this," he said, "I am not taking these people. I am now taking, except for about a dozen top doctorates, all my influx from technical colleges."

I think that we have got to recognize that the cutting edge has and always will come from the universities. You would not take a razor blade to cut a tree down; if you wish to cut a tree down, you take an axe with a good size blade. It must have a sharp edge but it must have mass and backing. We have got to have an unbroken spectrum from these people who give us our cutting edge right through to the machine shop man who actually is going to make whatever is devised at the front end. At least he is going to make what will put the ideas of the front end into practice. And, if anybody is stupid enough to perpetuate the idea that any part of that is more or less important than the other, the ultimate structure is going to be deficient.

I have liked to think that the modifications which are taking place in British technical education have been somewhat on the following basis: education up to, shall we say, the age of sixteen should be very broadly based, including a wide range of humanities as well as science. This is the way it is in Britain. Then you start to taper off for your specialization. The top part is your ultimate college subject. Our technical educational system was like that. But, I think that we could at all times say for the academically able group that this was a good sound foundation, but that we made the awful mistake at the very early age, the age of eleven or thereabouts, and said that there are those who can take this and there are those who cannot. I think that we are now very wise in saying that everybody is going to be educated to the age of sixteen on this broad basis. Naturally, the base will have to vary for them. One of the problems in this country is that this base is made not by laying bricks on top of one another, but by taking bricks of different sizes, different shapes, and chucking them at each other so that you have a loose pile. You cannot build a house on a loose pile of bricks.

My feeling is that this basis must be systematic, and it can only be systematic if it is imposed to some degree. President Beatty pointed out that about seventy percent do not have either a skill or an education. I have the problem at the moment of a young man from Blue Field, Virginia, whose parents are going to India. His father has asked me to take him into our technical school so that he can do electrical engineering. I have his high school and college transcripts, but I canot think of where to direct him. I have got to pick up a bit of trigonometry from here, a bit of calculus from there, a bit of geometry from there, a little chemistry from somewhere else, but it does not add up to the kind of systematic requirement which we insist upon. I think that it is a very nice theoretical idea that young people should have a choice, but would you allow your children to choose between a lot of pills that you put on a table without any guidance whatever; would you give them guns, matches or poison? I think that in education, untutored choice can lead to a very serious situation.

So, while we are coming toward you in accepting the fact that far more people are capable of being educated to a substantial level, I do hope that we do not go all the way and allow young people, who do not have the capability of making a good choice, to decide for themselves what they will do beyond the point of no return. Professor Frank asked the question as to where do we start. I think we start very low down and go on from there. If we do not start at a very early stage, then we can allow people as it were to go to the devil in their own way, and I do not think that we should do that. Thank you very much.

DR. GUNNING:

ALL I can tell you about our experience in British Columbia and Canada is what has been done to date. I cannot tell you about the results because at British Columbia it will be another year before any students graduate; we have operated for just one year. I think it is important to appreciate that the advances in technical and vocational education in Canada really stem from a Royal Commission. It was found in 1959 that we had in the previous decade (in the 1940's) been bringing, chiefly from Western Europe, over half of the technologists that we needed to maintain our industrial machine. The Commission concluded that there was a state of crisis: the House of Commons therefore passed the Vocational and Technical Training Act in 1961 whereby, for acceptable programs in vocational training and for the establishment of technical institutes, the Federal Government would provide within a limited time (about three years) 75% of the cost of buildings and equipment, and 50% of the operating costs of the vocational and technical institute programs. All of these were to be operated under the authority of the Provincial Department of Education, that is, the money was to go to the Provinces. In British Columbia, we had never had a technical institute before, but we had of course some vocational training.

In 1961, a great number of special committees were formed; they were supported and, I think, in many ways probably controlled by the professions and representatives of labor and of the universities. Their function was to draw up programs and to advise on the purchasing of equipment and the planning of buildings for seventeen programs in the British Columbia Institute of Technology. These programs were determined by previous surveys in the Province made largely by the Department of Education. All these committees had technical personnel from the Department of Education working with them as key staff members.

In 1962, the funds became available and building was started that fall as a crash program in which the architects played a very important part. We think we have a very fine building; it cost between three and four million dollars, and will accomodate 1,500 students. All together, there is about eight million dollars invested in the building and in the equipment.

The seventeen programs included two in the medical area (x-ray technology and medical laboratories), three in the business area (business management, commerce, hotel, motel and broadcast communications), and twelve in engineering or science technology ranging pretty well across the board, including building, mechanical, mining, etc. These programs were established, and we were fearful at the time that, because the idea had taken root that an education consisted of getting a B.A., there would not be any great rush for enrollment. We planned to take in about 750 students in the first year, but the applications exceeded the accommodations by about 100%, and therefore, we were able to pick and choose pretty well.

This development of technical institutes is going hand in hand with radical changes in our public school education. A Royal Commission investigated that topic also, and by 1967, we hope to have a new program in the high schools. This will mean that industrial arts, for example, will be available for 7th, 8th, 9th and 10th grades, but up to the tenth, there will be a solid basic core that everybody takes. At the end of grade ten, at about age sixteen, every student in the school should be able to go anywhere he likes. He can go into vocational education or he can make the decision that by grade 11 he will go into the technical and academic stream. Those students in the 11th and 12th grades will be able to go either to the University or the Technical Institute if they pick the appropriate options, which are close to our present university program.

It is interesting to me to analyze the students who were accepted by our Technical Institute. First, we accepted only those who had taken the University program in high school. In other words, they could have gone to the University if they had wanted, except that the University might have required high marks in certain subjects which we did not insist upon, and we were lenient with the second language requirements. The ones that were accepted had about a 62% to 65% average in the University program. In other words, they are roughly equivalent to people coming into engineering in the University. We cannot tell what the results will be, but we are hoping that we have a sound educational foundation to build on, similar to the University preparation.

Our whole program at the Institute is designed to teach mathematics and physics by their applications to problems rather than by teaching them in theory first. One other feature of nearly all the courses that I personally think is important, is that we do not fill them completely with prescribed work. We have tried to keep a few hours a week in each program (normally from two to about six hours) as a tutorial period, with staff present from the students' department, whether it is

mechanical or business. This is a time when students should feel, and the staff should make them feel, that somebody there is interested in their problems, and that the time can be devoted either to enriching their studies if they are good students, or in trying to correct their difficulties with the assistance of the department in which the difficulties arise.

Question: Dr. Gunning, can you tell us, since your program was initiated and started by the government, whether or not any legal definition of technologists was made, and whether any legal recognition was given? In other words, do they get any particular registration, do they get any standing whatsoever government-wise? This is a problem we suffer from in the States.

Dr. Gunning: I think we have the same problem. I think we can spend the rest of our time defining technologists and technicians, but the fact is that they will get diplomas from each of these institutes. I should have mentioned that the funds from Ottawa come from the Department of Labor. The Department supplies the funds to the provincial departments of education, and it has not attempted to set down any standard leading to Federal recognition. It is, of course, a fact that in the different provinces, there are the associations of engineers or architects and in Ontario and British Columbia, the professional engineers have worked closely with these people setting up screening standards which will lead to technological recognition. But there is no Federal standard insisted upon. The Federal insistence was on a minimum of 1,200 hours of instruction in a recognized program at post-high school level.

Question: Does this Federal aid you refer to filter down to the fifth and sixth and seventh grades, too, or does it start with technical schools?

Dr. Gunning: I am perhaps on dangerous ground, but as I understand it, it applies to vocational schools — it applies to technical schools, and to institutes. It also applies to acceptable vocational training in the high schools but I do not think it goes below that.

Comment: In the case of certain technical schools, if the total program that a student is taking is considered technical or vocational, then the Federal government will pay 75% of the capital costs (it has to be in the context of certain kinds of technical schools), and a portion of the operating cost.

Dr. Gunning: I should mention that of course in this Technical Vocational Training Act, there is allowance made for numerous things besides these schools. There is allowance made for support of students and retraining, there is specific allowance made for financing the training of teachers in the technical and vocational areas to allow them to take special courses.

Now, it might be of interest to note what funds have been involved in Canada to date (they were published Monday in a paper in Ottawa): the total committed under this Act since 1961 is just about $640 million, with the Federal government contributing, if I remember rightly, just a little under $390 million of that. Remember that the Federal government gives 75% of capital cost and 50% of operating.

Question: Dr. Gunning, do you expect these technical institutes to become technical colleges eventually granting a bachelor's degree?

Dr. Gunning: I hope not, but I could not answer for the local ambitions of certain people, you know.

Comment: I think it is fair to state that there are other kinds of higher educational institutions being set up at the same time which could eliminate the pressure for four-year institutions to be developed. There are vocational schools in many different parts of the Province, which are looking at the sub-technology areas; there are regional colleges being established in each of the local areas, and they will be working in some senses in part of the technology areas but not as technological institutes. It is expected that one or two of these may develop into four-year institutions.

Question: Is it expected in general that students will live in these institutes?

Dr. Gunning: Well, at present in Vancouver, they do not. As a matter of fact, as far as I know, they do not anywhere in Canada. We are making allowance for resident students in our broad plans and we have the land to erect residences, but we have not yet. Most of the students live in private homes around the institute, or something like that.

Question: Well, but they do move and their living is in the area?

Dr. Gunning: Oh, yes, and in the Federal act there is a provision that allows for certain payments to students coming from outside that area.

Participants in the March 6 Organization Meeting

H. R. Beatty, *President*
Wentworth Institute
550 Huntington Avenue
Boston, Massachusetts

Gordon S. Brown, *Dean*
School of Engineering
Massachusetts Institute of Technology
Room 3-246
Cambridge, Massachusetts

Frank C. Colcord, *Assistant to the Chairman of the Corporation*
Massachusetts Institute of Technology
Room 10-205
Cambridge, Massachusetts

Arthur Corazzine
Industrial Relations Section
Princeton University
Princeton, New Jersey

Nathan Cook, *Professor*
Department of Mechanical Engineering
Massachusetts Institute of Technology
Room 35-134
Cambridge, Massachusetts

Wallace Fletcher, *Consultant*
Newton School System
Walnut Street
Newton, Massachusetts

Nathaniel H. Frank, *Professor*
Department of Physics
Massachusetts Institute of Technology
Room 6-201
Cambridge, Massachusetts

James J. Hammond, *President*
Massachusetts State College at Fitchburg
Fitchburg, Massachusetts

Owen B. Kiernan, *Commissioner*
Massachusetts Department of Education
200 Newbury Street
Boston, Massachusetts

Ralph Lowell, *Chairman*
Boston Safe Deposit and Trust Company
Boston, Massachusetts

Robert W. Mann, *Professor*
Department of Mechanical Engineering
Massachusetts Institute of Technology
Room 3-447
Cambridge, Massachusetts

Walter J. Markham, *Director*
Division of Vocational Education
State Department of Education
Boston, Massachusetts

Paul E. Marsh, *Commissioner*
Massachusetts Education Study
43 Leon Street
Roxbury, Massachusetts

Robert Pruyt, *Superintendent of Schools*
Quincy, Massachusetts

Kevin H. Smith, *Deputy Director*
Educational Services, Incorporated
Watertown, Massachusetts

J. A. Stratton, *President*
Massachusetts Institute of Technology
Cambridge, Massachusetts

Robert R. Sweeney, *Headmaster*
Rindge Technical High School
Cambridge, Massachusetts

Participants in the April 30 - May 1 Planning Conference

Merton S. Anthony, *Superintendent*
Apprentice Training
General Electric Corporation
100 Woodlawn Avenue
Pittsfield, Massachusetts

Gerard Antonellis, *Head*
Industrial Arts Department
Stoughton High School
Stoughton, Massachusetts

Donovan Armstrong, *Program Specialist-Secondary Schools*
Office of Education
Division of Vocational and Technical Education
Washington, D.C.

Walter M. Arnold, *Assistant Commissioner*
U.S. Office of Education
Director of Vocational Division
Washington, D.C.

Charles Avadanian, *Head*
Industrial Arts Department
Malden School Department
Malden, Massachusetts

Stanley Backer, *Professor*
Department of Mechanical Engineering
Massachusetts Institute of Technology
Room 3-332
Cambridge, Massachusetts

LEONARD BALDWIN, *Professor*
Department of Civil and Architectural Engineering
University of Wyoming
Laramie, Wyoming

ROBERT BASSETT, *Research Associate*
Mass. Education Study
43 Leon Street
Boston, Massachusetts

ELIO BATTISTA, *Senior Instructor*
Wentworth Institute
550 Huntington Avenue
Boston, Massachusetts

H. R. BEATTY, *President*
Wentworth Institute
550 Huntington Avenue
Boston, Massachusetts

BRUCE BOAL, *President*
Hickok Teaching Systems
545 Technology Square
Cambridge, Massachusetts

EARL BOWLER, *Head*
Teacher Educator and Curriculum Unit
Office of Education
Vocational Division
Washington, D.C.

HERMAN A. BREITHAUPT
Commercial Foods Department
Chadsey High School
5355 Martin Avenue
Detroit 10, Michigan

DONALD M. BRILL, *Supervisor*
State Board of Vocational and Adult Education
14 North Carroll Street
Madison 3, Wisconsin

GORDON S. BROWN, *Dean*
School of Engineering
Massachusetts Institute of Technology
Room 3-240
Cambridge, Massachusetts

DR. DAVID BUSHNELL
Room 5044, G.S.A. Building
7th and D. Streets, S.W.
Washington, D.C.

G. H. CANNON, *Professor*
Faculty of Education
University of British Columbia
Vancouver 8, British Columbia, Canada

ANDREW CANEARELLI, *Consulting Civil Engineer*
17 Maynard Street
Arlington, Massachusetts

JAMES CLEMENS, *President*
Williamson School
Media, Pennsylvania

MAURICE M. COHEN, *President*
Lechmere Sales Company
Cambridge, Massachusetts 02141

FRANK C. COLCORD, *Assistant to the Chairman of the Corporation*
Massachusetts Institute of Technology
Room 10-205
Cambridge, Massachusetts

NATHAN COOK, *Professor*
Department of Mechanical Engineering
Massachusetts Institute of Technology
Room 35-134
Cambridge, Massachusetts

MAURICE DALY, *Assistant Superintendent*
Vocational-Technical Education
Quincy School Department
Coddington Street
Quincy, Massachusetts

STEPHEN S. DAVIS, *Dean*
School of Engineering and Architecture
Howard University
Washington, D.C.

WALTER DENNEN, *Director*
Worcester Industrial Technical Institute
Wheaton Square
Worcester 5, Massachusetts

PAUL W. DEVORE, *Director*
Division of Industrial Arts and Technology
State University College
Oswego, New York

MISS ANN DONOVAN, *Regional Field Coordinator*
Office of Education
Vocational Division
Washington, D.C.

WILLIAM DWYER, *President*
Massachusetts Board of Community Colleges
State House
Boston, Massachusetts

DAVID J. EMERY, *Personnel Manager*
Dynamics Research Corporation
Stoneham, Massachusetts

J. CLIVE ENOS, *Manager, Industrial Relations*
Raytheon Company
Hartwell Road
Bedford, Massachusetts

MARVIN FELDMAN, *Program Associate*
The Ford Foundation
477 Madison Avenue
New York, New York 10022

EDWARD FERRIS, *Administrator of Training*
Combustion Engineering Company, Inc.
Windsor, Connecticut 06095

MERTON FLEMINGS, *Associate Professor*
Department of Metallurgy
Massachusetts Institute of Technology
Room 35-316
Cambridge, Massachusetts

WALLACE FLETCHER, *Consultant*
Newton School System
Walnut Street
Newton, Massachusetts

HERBERT FORBELL, *Assistant Director of Industrial Arts*
Boston Public Schools
15 Beacon Street
Boston, Massachusetts

NATHANIEL H. FRANK, *Professor*
Department of Physics
Massachusetts Institute of Technology
Room 6-201
Cambridge, Massachusetts

EDMUND P. GARVEY, *Director*
Springfield Trade High School
Springfield, Massachusetts

FRANK GIDDINGS
Springfield Trade High School
Springfield, Massachusetts

MRS. HILDA W. GIFFORD, *Director*
Project FEAST
City College of San Francisco
San Francisco, California

H. C. GUNNING
British Columbia Institute of Technology
3700 Willingdon Avenue
Burnaby 2, British Columbia, Canada

JAMES J. HAMMOND, *President*
Mass. State College at Fitchburg
Fitchburg, Massachusetts

MICHAEL HARRIS
Organization for Economic Cooperation
and Development
2 Rue André-Pascal
Paris 16, France

DAVID HELBERG, *Principal*
Drake Vocational Guidance and Education Center
2641 South Calumet Avenue
Chicago 16, Illinois

DONALD HOPKINS, *Head*
Metallurgical Department
Swansea Technical College
Wales, England

DONALD E. IRWIN, *Manager*
Recruiting Development
Engineering Recruiting Service
General Electric Company
1 River Road
Schenectady, New York 12305

LAURENCE JARVIE, *General Superintendent of Schools*
Flint, Michigan

CHARLES P. JONES, *Director of Training*
Jordan Marsh Company
Boston, Massachusetts

HARRY KELLY, *Dean of Faculty*
North Carolina State University
Raleigh, North Carolina

WESLEY KETCHAM, *Consultant in Industrial Arts*
Connecticut State Department of Education
State Office Building
Hartford, Connecticut

OWEN B. KIERNAN, *Commissioner of Education*
Mass. Department of Education
200 Newbury Street
Boston, Massachusetts

JAMES R. KILLIAN, *Chairman of the Corporation*
Massachusetts Institute of Technology
Cambridge, Massachusetts

MELVIN KING
South End House
20 Union Park Street
Boston, Massachusetts

ERNEST KRAMER, *Chief*
Industrial Education
State Department of Education
State Education Building
721 Capital Mall
Sacramento, California

EDWARD LANDY, *Assistant Superintendent for Pupil Personnel*
Newton Public Schools
Newtonville, Massachusetts

GERALD LEIGHBODY, *Professor*
University of Buffalo
(State University of New York at Buffalo)
Buffalo, New York 14214

NORTON LONG, *Professor*
Brandeis University
Waltham, Massachusetts

DONALD MALEY, *Head*
Department of Industrial Education
University of Maryland
College Park, Maryland

ROBERT MANN, *Professor*
Department of Mechanical Engineering
Massachusetts Institute of Technology
Room 3-447
Cambridge, Massachusetts

WALTER MARKHAM
Massachusetts Vocational Director
200 Newbury Street
Boston, Massachusetts

PAUL MARSH, *Commissioner*
Massachusetts Education Study
43 Leon Street
Roxbury, Massachusetts

JOHN McHUGH
9 Prospect Street
Marblehead, Massachusetts

ROBERT L. McKEE, *Program Specialist*
Office of Education
Washington, D.C.

JOSEPH H. McPHERSON, *Manager*
Midland Division Psychology Department
The Dow Chemical Company
Midland, Michigan

ROBERT J. McVICKER
Wentworth Institute
550 Huntington Avenue
Boston 15, Massachusetts

BERNARD MICHAEL, *Program Evaluation Officer*
Office of Education
Washington, D.C.

E. GORDON MICKLEWRIGHT, *Manager*
Educational Aids Division
Stark Electronics Instruments, Ltd.
Ajax, Ontario, Canada

BEN F. MILLER, III, *Assistant Secretary*
Council on Dental Education
American Dental Association
222 East Superior Street
Chicago 11, Illinois

JOSEPH MINDEL
Lincoln Laboratory A163
Massachusetts Institute of Technology
Cambridge, Massachusetts

NEAL MITCHELL, *Associate Professor*
Department of Architecture
Graduate School of Design
Harvard University
Cambridge, Massachusetts

MISS GRACE L. NANGLE
Division of Vocational Education
200 Newbury Street
Boston, Massachusetts

JAMES B. O'BRIEN, *Consultant*
Division of Apprentice Training
Department of Labor and Industries
State House
Boston, Massachusetts

HENRY A. PAPPAS, *Superintendent of Schools*
Sturbridge, Massachusetts

GEORGE A. PARKINSON, *Director*
Vocational And Adult Schools
Milwaukee Institute of Technology
1015 North Sixth Street
Milwaukee 3, Wisconsin

ROBERT PRUITT, *Superintendent of Schools*
Quincy, Massachusetts

WINSTON D. PURVINE, *President*
Oregon Technical Institute
Klamath Falls, Oregon

LEE W. RALSTON, *Director*
Practical Arts Education
Los Angeles County Schools
185 W. Washington Boulevard
Los Angeles, California 90054

MISS MURIEL RATNER
Community College Health Careers Project
University of the State of New York
423 West 118th Street
New York, New York 10027

THOMAS A. ROCHE, *Director*
Vocational Education
15 Beacon Street
Boston, Massachusetts

GEORGE A. ROSE
Electronics Services Operation
Raytheon Company
Burlington, Massachusetts

L. L. SAMUEL
Stark Electronics Instruments, Ltd.
Ajax, Ontario, Canada

JOSEPH SILVA, *Acting Principal*
Weeks Junior High School
7 Hereward Road
Newton, Massachusetts

LEO F. SMITH, *Vice President*
Academic Administration
Rochester Institute of Technology
Rochester, New York

MALCOLM K. SMITH, *Executive Officer*
Science Teaching Center
Massachusetts Institute of Technology
Room 6-210

ROBERT SOLOW, *Professor*
Department of Economics
Massachusetts Institute of Technology
Room E52-383
Cambridge, Massachusetts

J. A. STRATTON, *President*
Massachusetts Institute of Technology

PAUL SULLIVAN
Blackstone Valley Regional School District
61 Church Street
Whitinsville, Massachusetts

ROBERT R. SWEENEY, *Headmaster*
Rindge Technical High School
Irving Street at Broadway
Cambridge, Massachusetts

ROBERT TAYLOR, *Director*
Center for Vocational and Technical Education
Ohio State University
980 Kinnear Road
Columbus, Ohio

AIMO H. TEITTINEN, *Principal*
Junior High School
Weston, Massachusetts

EVERETT THISTLE, *Director*
Elementary and Secondary Education
Mass. Department of Education
200 Newbury Street
Boston, Massachusetts

DAVID V. TIEDEMAN, *Co-Director*
Center for Research in Careers
Harvard University
8 Prescott Street
Cambridge, Massachusetts

LEWI TONKS
General Electric, retired
407 Oak Ridge Drive
Schenectady, New York 12306

ROBERT TROCCHI, *Senior Advisor*
Educational Council
Minneapolis Honeywell
Wellesley, Massachusetts

CECIL TYRRELL, *President*
Broome Technical Community College
Binghamton, New York

LESTER S. VANDER WERF, *Dean*
School of Education
Northeastern University
Boston, Massachusetts

LAWRENCE WATTS, *Assistant Superintendent for Instruction*
Jefferson County School District
1580 Yarrow Street
Lakewood, Colorado

WALTER WHIPPLE
Educational Development
Westinghouse Electric Company
Ardmore Boulevard
Brinton Road
Pittsburgh 21, Pennsylvania

SQUIRE L. WHITCOMB
International Business Machines
520 Boylston Street
Boston, Massachusetts

DAVID WHITE, *Professor*
Department of Electrical Engineering
Massachusetts Institute of Technology
Room 10-199
Cambridge, Massachusetts

JEROME WIESNER, *Dean of Science*
Massachusetts Institute of Technology
Room 6-215
Cambridge, Massachusetts

ROBERT WOOD, *Chairman*
Department of Political Science
Massachusetts Institute of Technology
Room 14N-207
Cambridge, Massachusetts

J. R. ZACHARIAS, *Professor*
Department of Physics
Massachusetts Institute of Technology
Room 26-425
Cambridge, Massachusetts

ANGELO ZUCCO, *Director of Training*
Lechmere Sales
Cambridge, Massachusetts